

The University of Chicago

A FACTOR ANALYSIS OF CERTAIN
NEUROTIC SYMPTOMS

A PART OF A DISSERTATION SUBMITTED TO THE
FACULTY OF THE DIVISION OF THE BIOLOGI-
CAL SCIENCES IN CANDIDACY FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY
1937

By

CHARLES I. MOSIER

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A FACTOR ANALYSIS OF CERTAIN NEUROTIC SYMPTOMS

CHARLES I. MOSIER

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In an attempt to investigate the concept of neurotic tendency thirty-nine of the forty-two most discriminative items in the Thurstone Neurotic Inventory were administered as a questionnaire to a group of five hundred male college students. An analysis of the table of intercorrelations by Thurstone's centroid method showed that eight factors were sufficient to account for the observed intercorrelations with negligible residuals. The eight centroid factors were then transformed into a simple structure. It is concluded that a single trait of neurotic tendency cannot be postulated and tentative hypotheses are formed as to the nature of the primary traits revealed by the analysis.

Readministering the same test to the same students a week later showed a high consistency of response both on the test as a whole, and on the individual items.

The purpose of this investigation is to apply the methods of multiple-factor analysis to certain questionnaire responses of the type generally termed 'neurotic symptoms,' with a view to determining whether there is a single factor of neuroticism common to all of them, and what behavior traits must be postulated to account for the observed interrelations of these items of behavior.

The writer has elsewhere (32) inquired into the validity of the present questionnaire type of personality test and the traits there measured. The present investigation is a consequence of the conclusions there reached. It is designed to go back of the total scores on personality questionnaires of the type represented by the Thurstone Neurotic Inventory (44), the Bernreuter Scales (4) and Flanagan revision (13), the Woodworth Personal Data Sheet (14), and others of a similar nature, in order to test the hypothesis that the scales are actually measuring a primary trait of neurotic tendency, and if they are not, to lay the basis for further work in the development of scales that will measure such single, psychologically significant traits.

The method of this present investigation is broadly as follows: the forty-two most diagnostic items from the Thurstone Neurotic Inventory (44) were administered as a questionnaire to a group of college men. For thirty-nine of the items, the intercorrelations between each item and every other item, and between each item and the A. C.

E. Psychological Examination were computed, and the resulting table of intercorrelations subjected to a multiple factor analysis by the centroid method of Thurstone (42). The resulting factorial matrix was then transformed into a simple structure (42, ch. VI) to determine the primary traits underlying this set of neurotic symptoms.

The concept of primary "trait" as used in this discussion (42, p. 51) is an operational definition, involving the operations of correlation, factor analysis and transformation to a simple structure. The significance of such a concept may best be followed in Thurstone's *Vectors of Mind*, pp. 44-54 (42). From there is quoted the following:

It is the faith of all science that an unlimited number of phenomena can be comprehended in terms of a limited number of concepts, or ideal constructs. . . . The constructs in terms of which natural phenomena are comprehended are man-made inventions. To discover a scientific law is merely to discover that a man-made scheme serves to unify, and thereby to simplify, comprehension of a certain class of natural phenomena. A scientific law is not to be thought of as having an independent existence which some scientist is fortunate to stumble upon. A scientific law is not a part of nature. It is only a way of comprehending nature. . . . Just as it is convenient to postulate physical forces in describing the movements of physical objects, so it is also natural to postulate abilities [or traits] and their absence as primary causes of the successful completion of a task by some individuals and of the failure of other individuals in the same task.

The criterion by which a new ideal construct in science is accepted or rejected is the degree to which it facilitates the comprehension of a class of phenomena which can be thought of as examples of a single construct, rather than as individualized events. . . . It is in the nature of science that no scientific law can be proved to be right. It can only be shown to be plausible. The laws of science are not immutable. They are only human efforts toward parsimony in the comprehension of nature.

The particular items chosen for this investigation were selected for two reasons: first, because the method of their determination by the authors of the Neurotic Inventory (40) indicated that if there were a common trait of emotionality or neuroticism, these items should manifest it; and second, they are representative of the current scales and measures as indicated in the following analysis, in which is shown for each of fifteen scales or studies the number of items identical with items in the thirty-nine finally selected.

Bernreuter-Flanagan (4, 12)	29
Bell Adjustment Inventory (3)	24
Harvey (18)	23
Willoughby (46)	18
Landis Inventory (24)	15
Laird B-2 (23)	13

Page Schizoid Traits (33)	12
Woodworth P. D. Sheet (14)	12
Maller Character Sketches (28)	12
Freyd-Heidbreder I-E Scale (19)	8
Guilford (16)	7

The items as presented to the subjects are reproduced in Table I. Three items, (nos. 14, 17, and 37) of the forty-two originally selected by the Thurstones as the most discriminating were rejected from this study after administration of the questionnaire because of the consistently low correlations of these items with the remaining items and with each other. The subject's score on the A. C. E. Psychological Examination (total score) was recorded as "above the median", or "below the median", and treated as the fortieth item (no. 43).

It must be urged that the variables under investigation are not the presence or absence of certain objectively verifiable attributes, but rather items of behavior in the strictest sense—making a mark in one position rather than in another position when confronted with a printed verbal statement. The primary datum is not, for example, the answer to the question, "Does this man have stage fright?", but to the question, "Does this man *say* that he has stage fright?" This does not mean that it is not legitimate to generalize beyond that restricted interpretation, but it does mean that such generalization must be made with full realization of the exact nature of the data on which that generalization is based. Guilford and Guilford emphasize this when they say of their similar material (17):

. . . . it is necessary to keep in mind the nature of the original data. We must constantly remember that the response of a subject may not represent exactly what the question implies in its most obvious meaning . . . responses represent the cooperative efforts of the subjects to give fair appraisals . . . of their behavior as they know it . . . The most parsimonious interpretation that can be given to the data is that we have applied 36 stimuli to 930 subjects . . . who by common instruction and in a common classroom situation have reacted to those stimuli in one of two ways. The intercorrelations between items then represent indicators of similar reactions to pairs of stimuli.

In order to give an example of the difficulties that may arise, the results may be anticipated by mentioning that item 24—"Are you touchy on various subjects?"—following as it does the question "Have you ever been depressed by low marks in school?", gives consistent evidence of having been interpreted by the college students to mean: "Are you touchy about various *college courses*?" The studies of Wrightstone

(48) and Landis and Katz (25) indicate that the percentage of agreement between questionnaire response and external criteria will, for such items as these, lie between 85% and 90%, so that generalization beyond the primary data is not impossible.

The subjects of this study were 500 male students of the University of Florida, gathered from classes in psychology, speech, political science, and English. For the most part they were freshmen or sophomores, and had never taken a course in psychology, or were taking their first course. The administration of the questionnaire was preceded by a short talk, urging the subjects' cooperation in a research project in psychology, stressing that the results were for research purposes only, and would be kept entirely confidential. The instructions were given orally, the effort being made to be sure that every subject understood what he was to do, rather than to keep the verbal form of the instructions rigidly uniform. Before the completed questionnaires were collected the subjects were told that if any of them, after seeing what was required of him, preferred not to turn in his paper, but to destroy it, that was permissible. No student availed himself of this privilege. Approximately one hundred papers were eliminated because of excessive number of "?" responses.

Without any warning, the questionnaire was administered a second time, as near to a week later as class schedules would permit. The results of this second administration were utilized only to obtain an estimate of the consistency with which each item was answered, and all subsequent computations except these "consistency coefficients" were based on the results of the first administration.

The items were scored according to the key furnished by the authors of the Neurotic Inventory, as neurotic or non-neurotic. In every case the "?" response was scored by the key as non-neurotic. In order to reduce the influence of the "?" response as a disturbing factor in the results, no paper was considered which returned more than three such responses. Five hundred cases were secured with both administrations of the questionnaire and with no more than three "?" responses. These cases formed the group on which this study was made.

Of the items selected for final analysis, only two were phrased negatively, so that the answer 'No' was considered neurotic. Because of the desirability of keeping the questions in their original form for purposes of comparison with other studies the wording of the items was left as it stood in the *Neurotic Inventory*. What effect this might have on the results is not known. Smith (38), however, investigating the effect of positive and negative phrasing, finds that the positive phrasing gives more reliable results.

The frequency of neurotic response to each of the thirty-nine items is reported in Table II. These results agree closely with the item-frequencies reported by previous investigators.

For each of the 780 pairs of items on the first administration, and for the two administrations of each item, four-fold distribution tables were prepared, and the tetrachoric coefficients of correlation computed as described in Chesire, Saffir and Thurstone (9). The use of the tetrachoric coefficient assumes a normal correlation surface of two continuous variates. That this assumption is warranted is indicated by the distributions published by Laird (20) for similar items. The mean correlation, exclusive of self-correlations, is .198. The standard error of a tetrachoric coefficient of .198 is .0728 as computed by the formula given by Kelley, (22, p. 258).*

The matrix of intercorrelations was factored by the method presented in detail in *Vectors of Mind*, Appendix I (42), using as an estimate of the communality the highest value in the column and revising this estimate for each factor. The method of reflecting tests described in Appendix I was followed for the first five factors, after which it was deemed advisable to use the more accurate method of reflecting tests until the sum of each column, without the diagonal entry, was positive. The use of this method insures that each successive factor makes a maximum contribution to the total variance.

The factorial analysis was continued until eight reference factors had been determined, when the standard deviation of the frequency distribution of the 780 residuals was .057 and the maximum contribution of the eighth factor to any single correlation was .082. While further factors might have been extracted, it was felt that their contribution to the total variance would be negligible.† The factorial matrix of the forty items referred to the centroid reference factors is presented in Table III.

The factorial matrix Table III is a complete description of the observed interrelations between this set of forty items of behavior (except, of course, for the neglected contribution of the eighth factor residuals). It would be quite possible to postulate a 'trait' for each of the eight reference vectors represented by the columns of the factorial matrix of Table III. A description of the data in terms of such 'traits' would be a valid description, in that the observed intercorrelations could be reproduced by matrix multiplication of that matrix

*The complete matrix of intercorrelations is presented in Mosier, C. I., *A factor analysis of certain neurotic symptoms*. Ph.D. Thesis, Univ. of Chicago Library, 1937.

†The matrix of eighth-factor residuals is presented in Mosier, *loc. cit.*

by its transpose. Such a description, and such "ideal constructs" as those "traits" would be, have, however, certain disadvantages, viewed as a scientific description. First of all, there exist an infinite number of such descriptions, each involving only eight traits, and each equally valid. Furthermore, such a description would have to be revised with every alteration in the set of items investigated. (Whence arise the criticisms of factorial methods of Line, Griffin and Anderson (26), Russell (35), Burks (6), Allport (1), and Chant (8).) Finally, such a description is not the most parsimonious possible. To overcome these disadvantages, it is necessary to transform the centroid matrix to a simple structure (42, ch. vi), so that each item is explained in terms of the fewest possible number of the eight traits.

Lotka (27, p. 372) in an entirely different context summarizes the significance of 'simple structure' in the following quotation:

Now an infinite number of equally appropriate pictures of this kind can be given for . . . the point, for the coordinates x, y, z , can be chosen in an infinite number of ways. But each choice of a system of coordinates will furnish its own particular set of functions ' f '; each picture will in this respect differ from every other such picture. Not a little of the success of the scientific investigator depends on his judgment in choosing a suitable system of coordinates, such as will furnish the simplest and most *convenient* picture, the most convenient functions of f . So, for example, the motion of the planets is most simply described with reference to a frame of coordinates fixed to the sun, and not, for example, one fixed to the earth. The discovery of a particularly convenient reference frame, though in a sense it adds nothing to our knowledge of concrete facts, may nevertheless constitute one of the major events in the progress of human knowledge.

In determining the simple configuration, the limitation that the primary traits be orthogonal was imposed after the oblique simple structure had been determined, and it had been seen that such a restriction would produce no great distortion from the oblique configuration. The assumption of orthogonality postulates traits uncorrelated in the population of individuals. It does not imply, as Allport seems to assume (2) that the traits are independent of one another in any but the statistical sense above. They may still "overlap", and may show interrelationships in the behavior items which are symptomatic of the traits.

The solution of the problem of simple structure was achieved by use of the procedure described by Thurstone (43), followed by graphic rotations until the simplest orthogonal configuration was attained. No assumption was made as to a positive manifold. The matrix of transformation L is reproduced in Table IV, and the Primary Trait

Matrix is presented in Table V. The significance of the identifying letters at the head of each column will be considered in the interpretations of the results. A sample of the graphic plots of each trait against every other for the final set of primary traits is presented in Fig. 1 showing traits 'C' and 'S'.

Table VI gives for each item its consistency coefficient—the self-correlation after an interval of one week—its communality and its specificity (42, p. 68). The consistency coefficients are comparable with those reported by Guilford and Guilford (17) for similar items. These are consistently higher than Guilford's, as would be expected from the fact that in the latter case the test-retest interval was one month. These consistency coefficients are subject to two distorting influences which prevent identification of them with the test-retest reliability coefficient, to which they bear formal correspondence. The first is the possibility that the subject remembered on the second occasion how he had answered on the first, and a desire to be consistent influenced the correlations. The second is that the answers were influenced by the mood of the moment, causing a lowering of the coefficients. The results of Johnson (21) bear on this second possibility.

The range of communalities is from .850 for item 41 to .153 for item 38. The specificities range from .009 for item 41, indicating that all of its variance not due to chance is explained by the eight primary traits, to a number of values greater than .50, indicating that for those items, the present investigation has accounted for less than half of the non-chance variance.

Interpretation of the primary traits—

Since the evidence upon which an interpretation of the psychological significance of the primary traits is based consists merely of the correlations obtaining between the items and that trait, the problem may be formulated thus: "What is the nature of the trait which would correlate x with item a , y with item b , and z with item c ?" Rephrased, the problem might be stated: "What is the nature of the trait such that an individual who possessed it to a strong degree would tend to make responses a , b , and c , and tend not to make responses d , e , and f (taking into account the varying strengths of the tendencies to respond)?" Obviously the answer to such a problem cannot be given categorically. The tentative answers here advanced are presented not so much as answers or as definition of the traits, as in the nature of hypotheses, each of which requires independent verification.

In discussing each trait the items which have high loadings

("high" arbitrarily defined as .24 or over) will be presented separately for convenience. For the exact wording of the item, refer to Table I. For the first trait (column C in Table V) those items are:

41. Ups and downs in mood	.85
11. Happiness to sadness	.81
31. Frequently in low spirits	.51
28. Often just miserable	.43
10. Worry over possible misfortune	.41
26. Frequently feel grouchy	.39
40. Cannot make up mind	.32
9. Burdened by a sense of remorse	.30
25. Often in a state of excitement	.29
16. Interests change quickly	.29
22. Mind wanders badly	.26
29. Bothered by some useless thought	.25
3. Worry over humiliating experiences	.25
6. Feelings easily hurt	.25

Inspection of these items indicates that the underlying trait might be termed '*cycloid*', indicative of the variability of mood expressed by the two highest items. The hypothesis of 'depression' must be rejected, since the second factor is clearly that. The close similarity between this trait and the trait 'E' reported by the Guilfords is all the more striking in view of the fact that only seven of their thirty-six items were similar to items in the present battery. In the trait as here determined, however, the cyclic nature of the trait is more apparent. This trait also bears similarity to Darrow's (10) constellation 'G'—excitability. The physiological measures of Darrow most consistently associated with this cycloid trait 'C' were his measures 9 and 18 (blood pressure rises after shock and percentage of association of the galvanic reactions to the conditioned stimuli with the conditioning stimuli). Both of these were negatively correlated with the items showing high loadings on 'C'. The blood pressure rise was most characteristically associated with the items having the lower loadings (items 25, 16 and 29).

The trait 'C' shows an interesting general correspondence to the personality items which Studman (39) finds characteristic of '*f*'. The correspondence between 'C' and Studman's '*f*', particularly the objective tests of '*f*', should be investigated. This trait shows similarities to the manic trait described by Thurstone (41) in his analysis of Moore's list of psychotic symptoms (29).

A possibility that should be considered in further investigations of the nature of this trait is that there exist two distinct traits, one manic in character and one depressive. The few manic and euphoric items in the present battery might not have been sufficient to separate the manic trait from a composite cycloid trait. The similarity between this trait and those determined by the Guilfords with a similar, and by Darrow with a different technique, raises the question whether it should not be called, as they have called it, "Emotionality". Since, however, emotionality is a rather vague term, and since the alternation of mood is the outstanding item in this and Guilfords' trait, it was felt that the term 'cycloid' described the most tenable hypothesis. To avoid crystallization of the hypothesis, however, the initial 'C' is to be preferred to the trait-name.

A consistent picture of *depression* is given by the second trait, designated 'D'. Its loadings are:

32.	Periods of loneliness	.71
4.	Lonesome, even with others	.68
31.	Frequently in low spirits	.59
28.	Often just miserable	.56
20.	Difficulty making friends	.50
26.	Frequently feel grouchy	.35
7.	Background on social occasions	.28
9.	Burdened by a sense of remorse	.27

The first two items, though they have been classed as indicative of social maladjustment by some *a priori* classifications (18, 46), are classed as symptomatic of depression on physiological bases by Darrow, of emotionality by Bell (3), and their intercorrelations in this study indicate that it is the depressed individual who *says* that he is lonely. The 'shut-in personality' aspect of these symptoms is manifested in the eighth factor. From what has been said above concerning the subjective nature of the stimulus items, it follows that a single item may have different meanings for different individuals. Thus, "lonesome, even with others" may mean depressed to one group of subjects, and shy or timid to another group. The effect of this would be that a single item would function as two distinct items showing high factor loadings on two traits. This is, of course, but one of several possible reasons for an item's having high loadings on more than one trait.

This trait of depression has appeared in previous studies, though

not always formally identified. Bridges (5) finds that the items of the Woodworth P. D. Sheet which differentiate delinquent girls from normals are those items which have high loadings on 'D'. Garrison (15), using the Thurstone Neurotic Inventory, finds the same result for women prisoners. Garrison's most differentiating items common to this study are 4, 28, 31, 9, and 40. Slawson (36) using the Mathews scale reports that the highest consistent differences between his delinquent boys and normals are in items of depression and tendency toward fatigue. Titley (45) in a study of the pre-psychotic personality in involuntional melancholia, reports asocial trends present. Cameron (7) in his study of depression in psychotics says "We have conjectured that the feelings of depression, sadness, *loneliness*, anxiety and apprehension . . . should be regarded as psychic pain due to the action of a stimulus." (*Italics added*). He also reports that the fluctuation rate of the Necker cube decreases with the depth of depression in psychotics.

The work of Darrow lends confirmation to the interpretation of this trait as depressive in character. All but one of the items listed here as having high loadings on 'D' were classed by Darrow in his 'depressed' category. The physiological measures most consistently associated with these items were low initial resistance, relative impermanence of conditioning and a high proportional change in resistance after shock. A trait of depression was likewise found by Thurstone (41) in his analysis of Moore's psychotic symptoms.

The relation of the 'D' factor to the 'C' factor should be noted. Because of the imposition of an orthogonal simple structure, these two traits as here defined are uncorrelated in the population of individuals. However, in the sample of behavior items investigated there is evidence that the same is not true for the universe of behavior items. Items which have high correlations with, and are symptomatic of 'C', tend also to have high loadings with, and to be symptomatic of 'D'. Whether this would obtain in a wider range of behavior items is an hypothesis, but an interesting one, and one which accords with clinical information.

The third trait presents evidence of being identifiable with *hyper-sensitivity* (using this term metaphorically rather than with any physiological implications) and has been designated 'H'. Its high loadings are:

6.	Feelings easily hurt	.52
19.	Cannot stand criticism	.47

5.	Consider self a nervous person	.45
25.	Often in a state of excitement	.42
15.	Easily discouraged	.40
3.	Worry over humiliating experiences	.38
26.	Frequently feel grouchy	.31
28.	Often just miserable	.30
40.	Cannot make up mind	.26
8.	Ideas run through head at night	.26

The position of item 25 as higher on 'H' than on 'C' is difficult to account for, and no satisfactory explanation has been found. With this single exception, the loadings are consistent with the hypothesis of a trait of 'sensitiveness'. The absence of item 24, ("Touchy on various subjects") proved puzzling until it appeared on a later factor in a position which renders it probable that the item was interpreted to mean: "Touchy on various *college* subjects". This trait is highly similar to Darrow's 'hypersensitive' category, and shows consistent negative relations with recovery reaction quotient, and degree of permanence of conditioning, together with a tendency towards positive relationship with percentage change in resistance after shock. The items which are high on 'H' are among Page's list of schizoid traits, serving to differentiate his normal subjects from manic patients. In the Guilfords' study this trait seems to be contained in their 'E' factor.

The fourth factor may be most parsimoniously termed 'lack of self-confidence'. The general pattern underlying it is *inferiority*, and it has been tentatively designated 'I'. The items which have high loadings on 'I' are:

34.	Lack self-confidence	.66
42.	Not self-confident about abilities	.59
15.	Easily discouraged	.50
39.	Feelings of inferiority	.43
22.	Mind wanders badly	.35
19.	Cannot stand criticism	.31
20.	Difficulty making friends	.30
33.	Self-conscious with superiors	.29
35.	Difficult to speak in public	.28
1.	Stage fright	.25

Individuals possessing high degrees of 'I' are marked by feelings of inferiority, and lack of self-confidence in general, with particular ref-

erence to abilities. This lack of self-confidence is most noticeable in social situations, though the inclusion of more items like 15 and 19 might show that the inferiority was not as confined to social situations as the present results might indicate. No hypothesis can be formed from the data at hand as to the genetic factors underlying this, or, indeed, any of the other factors. That must remain a problem for further investigation. However, Faterson's work (11) is suggestive. It is interesting to note that there was no relation between lack of self-confidence and intelligence as measured.

The loadings of the fifth factor are reproduced below:

12.	Troubled with shyness	.71
7.	Keep in background on social occasions	.67
39.	Feelings of inferiority	.60
2.	Difficulty starting conversation	.57
42.	Not self-confident about abilities	.52
34.	Lack self-confidence	.50
21.	Feeling of being watched on street	.48
18.	Bothered by being watched at work	.48
33.	Self-conscious in the presence of superiors ...	.46
20.	Difficulty making friends	.42
36.	Self-conscious, personal appearance	.34
30.	Hesitate to volunteer in class	.32
40.	Cannot make mind	.31
3.	Worry over humiliating experiences	.30
27.	Self-conscious reciting	.28
10.	Worry over possible misfortune	.25

Two facts are at once striking about this trait. The first is the extent to which it is in agreement with Guilfords' trait 'S', tentatively called by them 'Social Introversion'. This agreement is the more remarkable in that (as has been pointed out) there were but seven items common to the two studies. Such results as these verify the significance of the trait, and serve to validate the method. To quote Thurstone (42, p. 55):

"It is a fundamental criterion for a valid method of isolating primary abilities that the weights of the primary abilities for a test must remain invariant when it is moved from one test battery to another test battery."

The results on 'C' and 'S' present an empirical check on the validity of the method by that criterion.

The second fact of significance, which has already been anticipated, is the inter-relationship between 'S' and 'I'. Though measures of these two traits would show that they are uncorrelated in the population of individuals, there is evidence that they are inter-dependent in the universe of behavior items, in that there are many behavior symptoms which are indicative of either trait.

The loadings of items 40 and 10 are higher than might be expected, though they are not so high as to invalidate the hypothesis as to the nature of the trait, nor are they so wholly inconsistent with that hypothesis as to render it untenable. The relatively lower loadings of items 2 and 20 are to be explained by the fact that portions of their variance are already accounted for by other factors. (It is axiomatic that an item of behavior which is symptomatic for two traits cannot be as diagnostic of either as can an item which is a 'pure' measure of one trait alone. Mathematically this is expressed by the condition that the sum of the total variance, including specific and error variance, must be equal to unity.)

The items which are characteristic of this trait are classed together by Darrow in his "social" category. From his published results, none of the physiological measures studied appears characteristic of this trait. Seven of these items appear in Page's list of schizoid traits (33), but show no consistent differences between his three groups.

The next trait is interesting in that it appears to differentiate social self-consciousness in a different situation from that described by 'S'. 'S' seems to involve self-consciousness in the more intimate, face-to-face situations where the subject is himself a member of the group, whereas 'P' (which may be taken to stand for 'platform' or 'public-speaking') involves self-consciousness in the more formal situation of speaker-audience relation. This is advanced as an hypothesis subject to verification. This distinction accords with the common experience of finding that the 'good-mixer' may or may not have severe stage fright, and the bashful boy may make a skilled debater. The loadings on 'P' are:

35. Difficult to speak in public	.80
1. Stage fright	.77
27. Self-conscious reciting	.72
30. Hesitate to volunteer in class	.50

33. Self-conscious with superiors	.42
12. Troubled with shyness	.36
2. Difficulty starting conversation	.35

There is, as would be expected, a certain relation between 'S' and 'P', as shown by the fact that items 2, 12, 33, 27 and 30 have loadings on both factors. The items most diagnostic of one, however, have zero or near-zero loadings on the other. This trait corresponds to none in Guilford's analysis, though there is reason to suppose that it is included in his 'S' factor and might be separated from it by the inclusion of appropriate items in the battery to be analyzed. 'P' corresponds quite closely to Darrow's category which he designates anxiety. The physiological measure most characteristically associated with the highest items on 'P' is "percentage change in resistance after shock", that measure being correlated positively with four out of the five items highest on 'P'.

The two remaining factors are much less definite than the previous ones have been. They are, however, sufficiently consistent to admit of extremely speculative hypotheses as to their nature, indicating, at least, the direction of further investigation. The seventh factor loadings ('Co' of Table V) are here presented.

23. Depressed by low marks in school	.55
29. Bothered by some useless thought	.51
24. Touchy on various subjects	.35
30. Hesitate to volunteer in class	.33
38. Must do a thing over several times	.27
18. Bothered by being watched at work	.27
15. Easily discouraged	.25
22. Mind wanders badly	.25
2. Difficulty starting conversation	.24
20. Difficulty making friends	.36
43. Above median, Psychological Examination	.43

Item 23 may be interpreted as "received low marks in school" rather than as "*depressed* by low marks". That this is the interpretation given the item by the subjects is indicated, not only by the factor loadings, but the actual correlation coefficients themselves. There are three outstanding characteristics of this trait. It may be that the trait is a composite which later analysis will reveal as the linear sum of three traits, intellectual defect, social inadequacy of a particular sort, and

attentive difficulties (items 29, 22, 38, and possibly 43) or that this is a fundamental trait which underlies three seemingly distinct types of behavior. Neither hypothesis can be discarded without further investigation. As to the nature of the trait—or traits—three possibilities occur. The first is that some attentive defect operates to produce low grades, and to produce also a low score on the Psychological Examination, manifesting itself in the useless thought and mind-wandering. A second possibility is that these are samples of behavior symptomatic of an obsessive or compulsive trait. This hypothesis finds difficulty in explaining the negative loading of 'intelligence'. The third, and the one which appears most plausible is that the trait 'Co' represents the personality and behavior items which are caused by a cognitive defect—i.e., by the individual's finding himself below the average of the group in which he is placed. This hypothesis would consider the low intelligence test score as indicative of basic defect, rather than due to distractibility, leading directly to the low grades in school, the dissatisfaction with school subjects, the feeling of having to do something over, and the annoyance at being watched at work. It explains also the presence of item 30 with the absence of item 27. The hypothesis of cognitive defect experiences difficulty in explaining, however, the loadings on items 29 and 22, and the negative loadings on items 2 and 20 except as compensatory reactions. The question must be submitted to further experimental test of these, and possibly other, hypotheses.

The final factor likewise presents difficulties in interpretation, though the hypothesis of '*austic tendency*' (34) is tenable. The 'Au' trait has high loadings on:

13.	Daydream frequently	.62
32.	Periods of loneliness	.49
9.	Burdened by a sense of remorse	.48
36.	Self-conscious, personal appearance	.48
8.	Ideas run through head at night	.47
4.	Lonesome, even with others	.47
21.	Feeling of being watched on street	.46
29.	Bothered by some useless thought	.40
25.	Often in a state of excitement	.34
10.	Worry over possible misfortunes	.32
11.	Happiness to sadness without reason	.27
41.	Ups and downs in mood without cause	.25

The items with highest loadings are consistent with the clinical picture of the shut-in personality; three are represented in Page's list of schizophrenic traits (33); two are found diagnostic of schizophrenia by Landis and Katz (25) and one other by Smith (37). The relationship between 'Au' and 'D' obscures the results of any attempt to determine significant physiological measures from Darrow's study. Before this trait can be accepted as a significant category the hypothesis of 'autistic tendency' will have to be investigated more fully.

Again it must be urged that the behavior items and their loadings define the traits, and such terms as '*cycloid*', '*depression*', '*hypersensitivity*', '*inferiority*', '*social introversion*', '*public self-consciousness*', '*cognitive defect*', and '*autistic tendency*', represent merely working hypotheses whose value lies in directing future research into the underlying nature of these concepts which serve to reduce the observed interrelations of a set of forty variables to the simplest set of eight. This investigation is not to be looked upon as the end, but merely as a preliminary approach to the field.

Further research might well take three approaches to the problem. The first, and one which should precede the other two, is to extend the number and the range of behavior situations in which each trait is manifested. Problems would be formulated by selecting an hypothesis as to the nature of a single trait, determining, both *a priori* and empirically under what situations such a trait as that postulated might manifest itself, taking those behavior items as a battery, together with the other known traits as points of reference, and applying the multiple factor techniques. When this has been done and the range of behavior situations in which the trait is manifested is fairly extensive, some attempt at measurement of the trait will be possible. Any attempt to measure the traits as here determined, except a crude approximation, without further research would be premature and unwise. An extension of this method of attack, to be made after the behavior situations are fairly well-defined, is to discover more objectively determinable situations which are symptomatic of the trait. The lead offered by Studman's work (39, 40) for 'C' and by Cameron (7) on the fluctuation rate of the Necker cube in 'D' might be highly valuable.

The second attack on the problem, which can better be undertaken after the first is well under way, is the determination of the course of genetic development, and the etiology of each trait. It is, of course, by making possible such investigations that the first approach is valuable. Mere classification and labeling without an honest

attempt to discover further simplifications is sterile. However, before the etiology of a syndrome can be profitably studied, it must first be established that there *is* such a syndrome. This the previous experimental work in the field has failed to do—with, of course, certain all-too-rare exceptions.

A third method of approach which might well supplement the second, but which can scarcely precede the first, is the continuation of Darrow's attempt to discover physiological correlates of these traits—or of the traits that further research might indicate as more fundamental than these.

As to the effect of further research of the first type on these categories, one word might be said. It is quite possible that each of these traits will be discovered to be itself a composite of several others, more basic, just as there is evidence that Guilford's 'E' has been here broken up into 'C' and 'H', and that 'Co' will likely be found to be composite. It is quite improbable, however, that any two of these traits will be found by further research to be fundamentally one. Such a result could occur only through a highly artificial sampling of behavior items. While the number of dimensions of personality will undoubtedly increase beyond eight, both in this way and by the addition of entirely new concepts, it can be safely asserted that it is at least eight, even when personality is restricted to the 'single trait' of neurotic tendency.

Summary and conclusions—

In an attempt to investigate the concept of neurotic tendency, 39 of the 42 most discriminative items in the Thurstone Neurotic Inventory were administered as a questionnaire to a group of 500 male college students. The responses of 'Yes' or 'No' were considered as forcing a continuous variable into a dichotomy and the tetrachoric correlation coefficients between each item and every other item, and between each item and intelligence were computed graphically. The test-retest consistency coefficients for each item were computed, the retest occurring after an interval of one week. The table of intercorrelations was factored by the centroid method of Thurstone, and eight factors found sufficient to account for the observed intercorrelations with negligible residuals. The eight centroid factors were then transformed into a simple structure. From the results the following conclusions seem justified:

1. There is no single trait of neurotic tendency which can be postulated in a parsimonious description of behavior. The current questionnaires which purport to measure the single factor of neurotic tendency are composites of at least eight traits.

2. Tentative hypotheses have been formed as to the nature of these primary traits. Cycloid tendency, depression, hypersensitivity, lack of self-confidence, social maladjustment and self-consciousness in the speaker-audience situation appear to be well-verified as hypotheses. Autistic tendency and cognitive defect are offered as possible explanations for the two remaining traits.

3. The consistency of response to the individual items on two occasions a week apart is high. When this is used as an approximation to the reliability coefficient, the proportion of the variance of each item which remains unaccounted for (specific variance) has a median value of .23.

4. The results of this experiment show consistencies with other empirical attempts to determine behavior categories.

TABLE I
QUESTIONNAIRE ITEMS

1. Do you get stage fright?
2. Do you have difficulty in starting conversation with a stranger?
3. Do you worry too long over humiliating experiences?
4. Do you often feel lonesome, even when you are with other people?
5. Do you consider yourself a rather nervous person?
6. Are your feelings easily hurt?
7. Do you keep in the background on social occasions?
8. Do ideas run through your head so that you cannot sleep?
9. Are you frequently burdened by a sense of remorse?
10. Do you worry over possible misfortune?
11. Do your feelings alternate between happiness and sadness without apparent reason?
12. Are you troubled with shyness?
13. Do you day-dream frequently?
14. Have you ever had spells of dizziness?
15. Do you get discouraged easily?
16. Do your interests change quickly?
17. Are you easily moved to tears?
18. Does it bother you to have people watch you at work, even when you do it well?
19. Can you stand criticism without feeling hurt?
20. Do you have difficulty making friends?
21. Are you troubled with the idea that people are watching you on the street?
22. Does your mind often wander badly so that you lose track of what you are doing?
23. Have you ever been depressed because of low marks in school?
24. Are you touchy on various subjects?
25. Are you often in a state of excitement?
26. Do you frequently feel grouchy?
27. Do you feel self-conscious when you recite in class?
28. Do you often feel just miserable?
29. Does some particular useless thought keep coming into your mind to bother you?
30. Do you hesitate to volunteer in a class recitation?
31. Are you frequently in low spirits?
32. Do you often experience periods of loneliness?

33. Do you often feel self-conscious in the presence of superiors?
34. Do you lack self-confidence?
35. Do you find it difficult to speak in public?
36. Do you often feel self-conscious because of your personal appearance?
37. If you see an accident are you quick to take an active part in giving help?
38. Do you feel that you must do a thing over several times before you leave it?
39. Are you troubled with feelings of inferiority?
40. Do you often find that you cannot make up your mind until the time for action has passed?
41. Do you have ups and downs in mood without apparent cause?
42. Are you in general self-confident about your abilities?
43. (Above the median, A. C. E. Psychological Examination.)

TABLE II
PERCENTAGE FREQUENCY OF NEUROTIC RESPONSE TO EACH ITEM

Item Number	Description	Percentage Frequency
1.	Stage fright	.610
2.	Difficulty starting conversation	.286
3.	Worry over humiliating experiences	.458
4.	Lonesome, even with other people	.388
5.	Consider self a nervous person	.270
6.	Feelings easily hurt	.360
7.	Keep in background on social occasions	.336
8.	Ideas run through head at night	.346
9.	Burdened by a sense of remorse	.246
10.	Worry over possible misfortune	.354
11.	Happiness to sadness without reason	.374
12.	Troubled with shyness	.270
13.	Day-dream frequently	.658
15.	Easily discouraged	.300
16.	Interests change quickly	.450
18.	Bothered by being watched at work	.442
19.	Cannot stand criticism	.206
20.	Difficulty making friends	.102
21.	Feel watched on street	.158
22.	Mind wanders badly	.322
23.	Depressed by low marks in school	.668
24.	Touchy on various subjects	.394
25.	Often in a state of excitement	.248
26.	Frequently feel grouchy	.356
27.	Self-conscious reciting	.424
28.	Often feel just miserable	.228
29.	Bothered by some useless thought	.290
30.	Hesitate to volunteer in class	.476
31.	Frequently in low spirits	.240
32.	Periods of loneliness	.332
33.	Self-conscious with superiors	.456
34.	Lack self-confidence	.330
35.	Difficult to speak in public	.570
36.	Self-conscious, personal appearance	.338
38.	Must do a thing over	.360
39.	Troubled with feelings of inferiority	.290
40.	Cannot make up mind	.384
41.	Ups and downs in mood	.416
42.	Not in general self-confident	.264
43.	Above median of freshman class Psychol. Exam.	.538

TABLE III
CENTROID FACTOR LOADINGS

Item Number	Centroid Loadings							
	I	II	III	IV	V	VI	VII	VIII
1	448*	—513	328	140	212	—100	292	080
2	365	—550	—142	—132	097	106	143	—134
3	453	159	009	—025	—081	251	—062	—225
4	507	230	—424	—085	264	—191	—187	285
5	410	170	036	—125	215	135	139	—256
6	438	259	159	038	143	245	037	—102
7	383	—442	—272	—312	—119	153	095	051
8	391	221	—089	—250	156	—037	—191	—168
9	457	426	—130	—053	116	—113	—076	—097
10	456	259	—125	—129	—165	—081	095	—163
11	452	468	—175	283	—191	—244	333	—125
12	501	—631	—020	—099	—120	066	032	—090
13	356	206	040	045	111	—286	—409	—111
15	557	091	215	225	—053	274	—177	143
16	293	264	175	198	—152	081	—121	—099
18	405	—215	232	—272	—125	149	044	—063
19	329	166	303	110	155	267	—181	136
20	378	—414	—446	099	179	310	131	224
21	638	—132	—140	—098	—050	—125	—160	—184
22	302	192	134	244	—200	—107	—152	128
23	285	117	335	—255	—208	—132	145	178
24	426	154	161	—079	—050	—031	—033	177
25	371	316	177	117	261	—072	046	—247
26	512	297	—114	189	177	058	094	048
27	443	—494	315	—030	112	—237	187	108
28	562	457	—195	—164	082	120	211	132
29	394	369	205	—192	—257	—202	—126	028
30	356	—386	327	—229	009	—093	088	195
31	627	353	—257	017	054	068	250	209
32	577	357	—360	—231	223	—160	—102	257
33	536	—434	127	061	—019	—105	—059	—155
34	626	—417	—119	258	—115	181	—130	239
35	399	—560	264	171	219	—251	251	119
36	455	—161	—053	—119	015	—231	—211	—201
38	215	073	069	—161	—210	123	082	072
39	640	—322	—067	071	—241	050	—183	—048
40	558	073	120	002	—132	078	043	—086
41	493	524	—281	283	—241	—108	296	—129
42	418	—479	—126	184	—269	113	—250	183
43	139	—035	—235	230	210	137	—182	—289

*Decimal points properly preceding each entry have been omitted.

TABLE IV
MATRIX OF TRANSFORMATION TO SIMPLE STRUCTURE

Centroid Factor	Primary Trait							
	C	D	H	S	I	P	Co	Au
I	392*	342	326	285	332	488	171	404
II	436	172	261	-473	-240	-530	267	278
III	-111	-503	355	413	057	-215	615	-093
IV	402	-253	000	045	682	-373	-381	-156
V	-379	355	472	383	-087	-399	-416	146
VI	-078	065	626	-422	094	275	-040	-577
VII	550	150	-044	442	-467	-009	-085	-505
VIII	-172	619	-288	044	360	-246	441	-343

*Decimal points properly preceding each entry have been omitted.

TABLE V
PRIMARY TRAIT MATRIX

Item Number	Loadings on Primary Traits							
	C	D	H	I	S	P	Co	Au
1	048*	026	131	252	234	766	017	-098
2	-079	118	075	048	572	350	-235	-045
3	250	020	380	067	302	-117	064	183
4	073	679	006	181	026	-032	-032	467
5	206	129	452	-156	163	121	-034	199
6	251	115	518	077	065	032	112	119
7	-057	282	-068	001	668	128	-043	-067
8	026	200	260	-089	155	-055	042	467
9	298	271	236	-011	-010	-076	050	481
10	409	151	083	-103	248	-046	113	316
11	808	141	-011	010	-057	013	-012	274
12	-045	009	003	218	708	362	-052	002
13	023	018	106	221	-054	000	075	620
15	202	098	397	498	154	012	254	075
16	289	-125	240	221	000	-106	179	168
18	001	-013	206	003	475	206	274	020
19	010	097	471	307	-057	016	244	046
20	002	500	067	299	420	126	-361	-228
21	142	131	080	170	479	139	-013	461
22	262	-011	-001	349	-053	-031	248	190
23	165	066	008	-090	104	203	549	066
24	158	200	143	142	094	102	346	176
25	290	001	417	-004	-134	174	-006	342
26	387	346	310	187	-026	052	-036	199
27	-026	033	-009	180	278	720	149	037
28	431	560	298	-092	099	-069	158	190
29	252	033	047	-002	063	-057	507	403
30	-140	084	020	096	319	503	328	-018
31	513	591	200	085	116	016	081	142
32	161	714	088	035	061	-045	100	490
33	045	-092	080	293	459	419	-018	223
34	100	236	046	655	499	172	-018	-030
35	005	040	-022	282	184	799	-036	-036
36	-003	022	023	109	344	184	-019	475
38	147	081	067	-032	214	-041	267	-038
39	145	042	041	425	595	113	045	209
40	317	053	256	144	306	106	196	180
41	849	199	038	037	014	-128	-035	246
42	-033	066	-134	585	516	049	004	-018
43	017	-019	228	174	083	-101	-428	172

*Decimal points properly preceding each entry have been omitted.

TABLE VI
ANALYSIS OF RELIABILITY, COMMUNALITY, AND SPECIFICITY

Item Number	r_{jj}	h_j^2	s_j^2
	Reliability	Communality	Specificity
1	.95	.738	.212
2	.91	.532	.378
3	.87	.355	.515
4	.88	.719	.161
5	.97	.363	.607
6	.93	.378	.552
7	.92	.563	.357
8	.88	.363	.517
9	.58	.451	.129
10	.74	.377	.363
11	.87	.757	.113
12	.88	.687	.192
13	.91	.447	.463
15	.85	.545	.305
16	.87	.279	.591
18	.89	.382	.508
19	.83	.386	.444
20	.93	.718	.212
21	.91	.531	.379
22	.82	.296	.524
23	.90	.386	.514
24	.85	.273	.577
25	.86	.419	.441
26	.79	.445	.345
27	.88	.656	.224
28	.83	.673	.157
29	.77	.494	.276
30	.92	.490	.430
31	.79	.698	.092
32	.84	.795	.045
33	.82	.534	.286
34	.91	.766	.144
35	.93	.760	.170
36	.86	.388	.472
38	.81	.153	.657
39	.88	.619	.261
40	.90	.364	.536
41	.86	.851	.009
42	.78	.635	.145
43	—	.308	—

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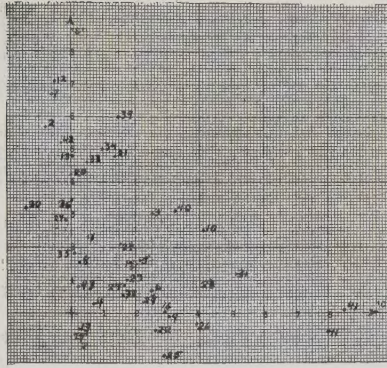


FIGURE 1

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